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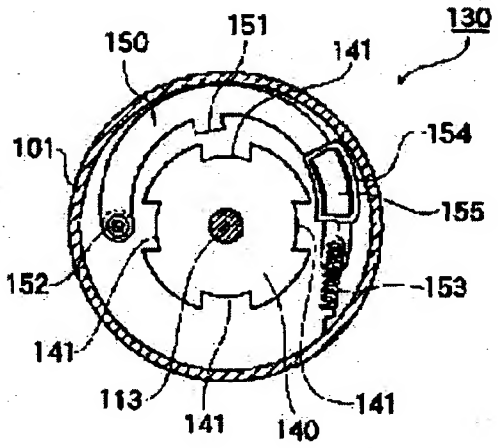
(54) STEERING CONTROL DEVICE FOR VEHICLE

(57)Abstract:

PROBLEM TO BE SOLVED: To surely operate a lock mechanism of a transmission ratio varying mechanism by changing a transmission ratio between an input shaft-an output shaft by rotary driving of a motor, performing an operation control for the motor together with an operation control of a driving means and controlling locking of a tilting member and a rotating member and releasing of the locking.



SOLUTION: A lock arm 150 is normally energized so as to be tilted to a lock holder 140 side with a supporting pin 152 as a center by an action of a spring 153, a state that an engagement projecting part 151 of the lock arm 150 enters into an engagement recessed part 141 of the lock holder 140 is made, the lock holder 140 and the lock arm 150 are locked each other and a lock state is made. When an electromagnetic coil 154 is energized, repulsive force is generated between the coil 154 and a metallic plate 155, the lock arm 150 is tilted so as to be away from the lock holder 140, and the engagement projecting part 151 of the lock arm 150 is moved to the outside of the engagement recessed part 141 of the lock holder 140 and locking of the lock holder 140 and the lock arm 150 is released.

LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] The steering control unit for vehicles which is characterized by providing the following and which performs steering control of vehicles. A transfer-ratio adjustable means to have the output shaft connected with an input-shaft [which is connected with a steering handle side], and ****** side, and to change the transfer ratio between input-shaft-output shafts by the rotation drive of a motor. A rotation position detection means to detect the rotation position of the aforementioned motor. tilting supported free [tilting] to the stator side which constitutes the aforementioned motor -- a member Lock control means it is fixed to the driving means to which the aforementioned tilting member is made to tilt, and Rota which constitutes the aforementioned motor, carry out the motion control of a motor with the aforementioned tilting member, the rotation member which has the section which can be stopped, and which can be stopped at intervals of predetermined, and the motion control of the aforementioned driving means, and control a stop with the aforementioned tilting member and a rotation member, and stop release.
[Claim 2] the aforementioned lock control means -- the aforementioned tilting member -- rotation -- a member -- the aforementioned rotation detected by the tilting control means which make the aforementioned driving means drive, and the aforementioned rotation position detection means so that it may tilt to a side -- the steering control unit [equipped with the rotation position of a member, and the rotation drive motor-control / motor / aforementioned] means based on a position error with the aforementioned section which can be stopped / according to claim 1 for vehicles
[Claim 3] the aforementioned lock control means -- the aforementioned tilting member -- rotation -- a member -- the steering control unit for vehicles according to claim 1 equipped with the tilting control means which make the aforementioned driving means drive, and the motor control means which carries out the rotation drive of the aforementioned motor at least more than the formation interval of the aforementioned section which can be stopped so that it may tilt to a side
[Claim 4] The aforementioned lock control means are steering control units for vehicles according to claim 3 which it has further in a failure judging means judge it as what failure generated in the lock mechanism by the aforementioned tilting member and the rotation member when the rotation of the aforementioned motor obtained based on the detection result of the aforementioned rotation position detection means becomes more than the formation interval of the aforementioned section which can be stopped.
[Claim 5] The aforementioned lock control means are steering control units for vehicles according to claim 1 equipped with the tilting control means which make the aforementioned driving means drive, and a motor control means to make the aforementioned motor reciprocate in the predetermined range so that the aforementioned tilting member may estrange from the aforementioned rotation member.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the steering control unit for vehicles equipped with the transfer-ratio adjustable mechanism.
[0002]
[Description of the Prior Art] The steering control unit which carried from the former the transfer-ratio adjustable mechanism in which the transfer ratio between the steering angle of a steering handle and ****** of ****** was changed is known. For example, the steering control unit which equipped JP,11-34894,A with the lock mechanism which locks the differential mechanism in such a transfer-ratio adjustable mechanism is indicated. This lock mechanism is the mechanism in which the heights of the lock arm fixed to the motor housing side are stopped, to the crevice of the body of revolution fixed to the motor axis of rotation of a transfer-ratio adjustable mechanism.
[0003]
[Problem(s) to be Solved by the Invention] Thus, since a lock mechanism was a mechanism with which a crevice and heights are made to engage, the physical relationship of the crevice of body of revolution and the heights of a lock arm was not in agreement, at the time of a lock, there may be no lock from skillful ****, and there was a case where there was no lock release in skillful ****, by the bite lump by the lock arm and body of revolution at it at the time of lock release.
[0004] this invention is made that such a technical problem should be solved, and the purpose is in offering the steering control unit for vehicles which may operate the lock mechanism of a transfer-ratio adjustable mechanism certainly.
[0005]
[Means for Solving the Problem] Then, the steering control unit for vehicles concerning a claim 1 A transfer-ratio adjustable means to be the steering control unit for vehicles which performs steering control of vehicles, to have the output shaft connected with an input-shaft [which is connected with a steering handle side], and ****** side, and to change the transfer ratio between input-shaft-output shafts by the rotation drive of a motor, A rotation position detection means to detect the rotation position of a motor, and the tilting member supported free [tilting] to the stator side which constitutes a motor, The driving means to which a tilting member is made to tilt, and the rotation member which is fixed to Rota which constitutes a motor and has the section in which a tilting member and a stop are possible, and which can be stopped at intervals of predetermined, Motion control of a motor is performed with the motion control of driving means, and the lock control means which control a stop with a tilting member and a rotation member and stop release are had and constituted.
[0006] Although the lock and lock release of a differential mechanism in a transfer-ratio adjustable means are made by a stop with a tilting member and a rotation member, and stop release, in addition to the motion control of driving means, lock control means perform motion control of a motor in this case. thereby -- the time of a lock -- rotation -- when it becomes possible to certainly make in agreement the physical relationship of the section of a member which can be stopped, and a tilting member and the bite

lump has arisen between the tilting member and the rotation member at the time of lock release, control of which this bite lump is canceled in operating a motor can be carried out
[0007] lock control means [in / a claim 1 / in the steering control unit for vehicles concerning a claim 2] -- a tilting member -- rotation -- a member -- the rotation detected by the tilting control means which make driving means drive so that it may tilt to a side, and the rotation position detection means -- the rotation position of a member and the rotation drive motor control / motor / means based on a position error *with the section which can be stopped are had and constituted*
[0008] tilting control means -- a tilting member -- rotation -- a member -- a rotation member is rotated by the motor control means to the section which can be stopped based on the position error which got mixed up with this control and was detected at the same time it makes it tilt in a side, i.e., the lock direction Thereby, a rotation member and a tilting member can be stopped certainly.
[0009] lock control means [in / a claim 1 / in the steering control unit for vehicles concerning a claim 3] -- a tilting member -- rotation -- a member -- the tilting control means which make driving means drive, and the motor control means which carries out the rotation drive of the motor at least more than the formation interval of the section which can be stopped are had and constituted so that it may tilt to a side
[0010] rotating a rotation member at least by the motor control means more than the formation interval of the section which can be stopped, after making a tilting member tilt in the lock direction by tilting control means -- rotation -- since the section of a member which can be stopped serves as the situation of surely passing through the position which faces a tilting member, a rotation member and a tilting member can be stopped certainly
[0011] When the rotation of the motor by which the lock control means in a claim 3 are obtained based on *the detection result of a rotation position detection means becomes more than the formation interval* of the section which can be stopped, the steering control unit for vehicles concerning a claim 4 equips further the lock mechanism by the tilting member and the rotation member with a failure judging means judge it as what failure generated, and constitutes.
[0012] Although rotation of a motor will stop if a rotation member stops with a tilting member, when failure occurs in a lock mechanism, a tilting member and a rotation member do not stop mutually, but a motor continues rotation more than the formation interval of the section which can be stopped. This situation is judged by the failure judging means.
[0013] The steering control unit for vehicles concerning a claim 5 equips with and constitutes the tilting control means which make driving means drive, and a motor control means to make a motor reciprocate in the predetermined range so that a tilting member may estrange [the lock control means in a claim 1] from a rotation member.
[0014] Although a tilting member is made to tilt by tilting control means at the time of lock release so that it may estrange from a rotation member, a motor is made to reciprocate in the predetermined range by the motor control means at the time of this control processing. thereby -- a tilting member -- receiving -- rotation -- it will be in the state where the section of a member which can be stopped *displaces in vibration, and it acts so that the bite lump between a tilting member and a rotation member* may be canceled by this movement
[0015]
[Embodiments of the Invention] Hereafter, with reference to an accompanying drawing, it explains about the operation gestalt of this invention.
[0016] The composition of the steering control unit which equipped drawing 1 with the transfer-ratio adjustable mechanism concerning the 1st operation gestalt is shown.
[0017] The transfer-ratio adjustable mechanism 100 has the input shaft 20 connected with the steering handle 10 side, and the output shaft 40 connected with Wheel FW side, and has formed the steering angle sensor 60 which detects steering angle thetah of the steering handle 10 to the input shaft 20. Moreover, the output shaft 40 is connected with the rack shaft 51 through the gear equipment 50 of a rack-and-pinion formula, and Wheel FW is connected with the both sides of the rack shaft 51.
[0018] The transfer-ratio adjustable mechanism 100 is expanded and is roughly shown in drawing 2 .

The transfer-ratio adjustable mechanism 100 is equipped with the motor 110, the reducer 120, and the lock mechanism 130, and has the function to change the transfer ratio of the rotation between the input-shaft 20-output shafts 40.

[0019] A motor 110 is equipped with the angle-of-rotation sensor 102 (refer to drawing 1) which detects angle-of-rotation thetam of a motor, and constitutes the servo motor which can control a rotation position while it is equipped with the stator 111 fixed in the motor housing 101, and Rota 112 supported free [rotation in the motor housing 101].

[0020] The reducer 120 constitutes the epicyclic gear mechanism and is fixing the sun gear 121 located in a core to the axis of rotation 113 rotated in one with Rota 112. Moreover, to it, the planetary gear 122 which revolves the circumference of a sun gear 121 around the sun is arranged at equal intervals, rotating around a sun gear 121, and each planetary gear 122 is supported free [rotation] with the carrier 123 connected with the input shaft 20. The starter ring 124 formed in the inner skin of the motor housing 101 is allotted, and the motor housing 101 is connected with an output shaft 40, and is constituted so that each planetary gear 122 may furthermore be surrounded.

[0021] Moreover, the part shown by the A-A line between a motor 110 and a reducer 120 is equipped with the lock mechanism 130 which locks the differential mechanism of a transfer-ratio adjustable mechanism. This lock mechanism 130 equips with and constitutes the lock electrode holder 140 of a disk configuration, and the lock arm 150 which curved circularly, as shown in drawing 3 .

[0022] It is fixed to the axis of rotation 113 which penetrates a core, and the lock electrode holder 140 rotates the lock electrode holder 140, the axis of rotation 113, and Rota 112 in one. Moreover, the engagement crevice 141 is formed in the periphery section of the lock electrode holder 140 at the predetermined intervals.

[0023] On the other hand, the lock arm 150 projects and forms in the lock electrode-holder 140 side the engagement heights 151 engaged in the engagement crevice 141 of the lock electrode holder 140. moreover, the end face section of the lock arm 150 is supported free [tilting] centering on the support pin 152 by the support pin 152 fixed to the motor housing 101 -- having -- **** -- the point of the lock arm 150 -- electromagnetism -- a coil 154 -- having -- this electromagnetism -- the metal plate (magnet board) 155 fixed to the position which faces a coil 154 at the motor housing 101 side is arranged Furthermore, the other end of the spring 153 which fixed the end to the motor housing 101 is being fixed to the point of the lock arm 150.

[0024] Thus, as the lock arm 150 is always energized by the operation of a spring 153 so that it may tilt to the lock electrode-holder 140 side centering on the support pin 152, and it is shown in drawing 3 , it will be in the state where the engagement heights 151 of the lock arm 150 enter in the engagement crevice 141 of the lock electrode holder 140, the lock electrode holder 140 and the lock arm 150 of each other are stopped, and, thereby, relative rotation with the motor housing 101 and Rota 112 is prevented. For this reason, the operation of the adjustable mechanism of a transfer ratio becomes impossible, and the transfer-ratio adjustable mechanism 100 will be in a lock state.

[0025] on the other hand -- electromagnetism -- if energized by the coil 154 -- between metal plates 155 -- electromagnetism -- as shown in drawing 4 , repulsive force [-like] occurs, the lock arm 150 is tilted so that it may estrange from the lock electrode holder 140, the engagement heights 151 of the lock arm 150 move out of the engagement crevice 141 of the lock electrode holder 140, and a stop with the lock electrode holder 140 and the lock arm 150 is canceled by the operation This will be in the state which the motor housing 101 and Rota 112 can relative rotate, and the transfer-ratio adjustable mechanism 100 is the mechanism canceled of a lock state.

[0026] If the angle of rotation of an output shaft 40 is set to output angle thetap here, since the relation of steering angle thetah, angle-of-rotation thetam of a motor 110, and output angle thetap will turn into a relation shown by (1) formula and the relation of steering angle thetah, output angle thetap, and a transfer ratio G will be prescribed by (2) formulas, (3) formulas can show angle-of-rotation thetam of a motor 110 from (1) formula and (2) formulas. In addition, "K" in a formula is the reduction gear ratio of a reducer 120.

[0027]

thetap=thetah+K-thetam -- (1)
thetap=G-thetah -- (2)
thetam=(G-1) -thetah/K -- (3)
Therefore, transfer-ratio control between the input-shaft 20-output shafts 40 can be performed by controlling angle-of-rotation thetam of a motor 110 according to steering angle thetah based on (3) formulas based on the set-up transfer ratio G. In addition, output angle thetap corresponds to the stroke position of the rack shaft 51, and further, since the stroke position of the rack shaft 51 corresponds to ****** of Wheel FW, it can detect output angle thetap from (1) formula by detecting steering angle thetah and angle-of-rotation thetam, and can detect ****** of Wheel FW based on this detected output angle thetap.
[0028] Thus, the transfer-ratio adjustable mechanism 100 to constitute and motion control of the lock mechanism 130 are carried out by the steering control unit 70, and based on each detection result of the steering angle sensor 60, the angle-of-rotation sensor 102, and the vehicle speed sensor 71, the steering control unit 70 outputs a control signal Is to a motor 110, and carries out drive control of the transfer-ratio adjustable mechanism 30. moreover -- the time of a lock and lock release -- electromagnetism -- predetermined control of the energization control to a coil 154 etc. is carried out
[0029] Here, the processing carried out with the steering control unit 70 is explained along with the flow chart of drawing 5 .
[0030] This flow chart starts by ON operation of an ignition switch. Since as for the inside of an OFF state the lock mechanism 130 of the transfer-ratio adjustable mechanism 100 operates and the ignition switch is in the lock state, first, it progresses to Step (a step is hereafter described as "S".) 200, and lock release control of which the lock state of the transfer-ratio adjustable mechanism 100 is canceled is performed.
[0031] This lock release control is shown in the flow chart of drawing 6 .
[0032] first -- S202 -- electromagnetism -- energization is started in a coil 154 and driving force is given in the direction estranged from the lock electrode holder 140 to the lock arm 150
[0033] In S204 continuing, the predetermined control signal Istart1 specified beforehand is outputted to a motor 110. This control signal Istart1 is a control signal set up beforehand, in order to make a motor 110 reciprocate in vibration in the predetermined range, and sufficient range for the range made to reciprocate to cancel the bite lump by the engagement heights 151 of the lock arm 150 and the engagement crevice 141 of the lock electrode holder 140 is set up. And in S206 continuing, the angle of rotation thetam1 of the motor 110 at the time of ending processing of S204 is read.
[0034] In S208 continuing, the predetermined control signal Istart2 specified beforehand is outputted to a motor 110. This control signal Istart2 is a control signal beforehand set up so that the lock electrode holder 140 might rotate by the angle of rotation which serves as size from the formation width of face of the engagement crevice 141. And in S210 continuing, the angle of rotation thetam2 of the motor 110 at the time of ending processing of S208 is read.
[0035] The deflection delta of an angle of rotation thetam2 and an angle of rotation thetam1 is set up as delta=theta m2-thetam1, and it judges whether deflection delta is more than threshold deltath by S214 continuing S212 continuing. This threshold deltath is taken as the angle of rotation of the motor 110 corresponding to the formation width of face of the engagement crevice 141 in the lock electrode holder 140.
[0036] Consequently, when judged as "Yes" by S214, the lock electrode holder 140 is rotating more than the formation width of face of the engagement crevice 141, it can check that the stop with the lock arm 150 has been canceled by this, and this routine is ended as it is. On the other hand, when judged as "No" by S214, by some causes, such as a malfunction of a bite lump or the lock arm 150, can judge it as that by which stop release with the lock electrode holder 140 and the lock arm 150 was not carried out, progress to S216 in this case, the trouble indication lamp in which failure of the lock mechanism 130 is shown is made to turn on, an operator is told about generating of failure, and this routine is ended.
[0037] Thus, immediately after ON operation of an ignition switch, lock release control shown by S202-S216 is performed. In addition, especially the order of processing of S202 and S204 may not limit, and

may be performed simultaneously.
[0038] It progresses to S102, after returning to drawing 5 again and performing lock release control (S200). In S102, the vehicle speed V detected by steering angle thetah detected by the steering angle sensor 60, angle-of-rotation thetam of the motor 110 detected by the angle-of-rotation sensor 102, and the vehicle speed sensor 71 is read, respectively.
[0039] continuing -- S -- 104 -- **** -- drawing 7 -- being shown -- the vehicle speed -- V -- a transfer ratio -- G -- a relation -- being shown -- a map -- from -- S -- 102 -- having read -- the vehicle speed -- V -- a basis -- a map -- reference -- carrying out -- the vehicle speed -- V -- having responded -- a transfer ratio -- G -- setting up -- continuing -- S -- 106 -- **** -- the above -- (-- three --) -- a formula -- using -- S -- 102 -- having read
[0040] In S108 continuing, the angle deflection e of target angle-of-rotation thetamm set up by S106 and angle-of-rotation thetam read by S102 is set up as e=thetamm-thetam.
[0041] In S110 continuing, without overshooting, the control signal Is which controls a motor 110 is determined so that deflection e may be set to 0. As an example of this processing, a control signal Is can be determined by setting up the parameter of PID control appropriately based on the operation expression of Is=C(s) and e. In addition, (s) in a formula is the Laplacian operator.
[0042] Processing after S102 mentioned above is repeated and performed until output the control signal Is determined by S110 to a motor 110 in S112 continuing, drive a motor 110 according to a control signal Is, it progresses to S114 after this, and it judges whether OFF operation of the ignition switch (IG) was carried out, and returns S102 in "No" and is judged as "Yes" by S114.
[0043] And when OFF operation of the ignition switch is carried out, it progresses to "Yes") and S300 by (S114, and lock control which locks the transfer-ratio adjustable mechanism 100 is performed.
[0044] This lock control is shown in the flow chart of drawing 8 .
[0045] S310 -- first -- electromagnetism -- the energization to a coil 154 is stopped This tilts the lock arm 150 to the lock electrode-holder 140 side centering on the support pin 152 according to the stability of a spring 153.
[0046] In S312 continuing, angle-of-rotation thetam of the motor 110 in which the rotation position of the lock electrode holder 140 at this time is shown is read.
[0047] The lock electrode holder 140 chooses as the steering control unit 70 nearby position thetamr which can be locked to angle-of-rotation thetam read by S312 by S314 which is made to memorize beforehand the rotation position in which the lock arm 150 and a lock are possible, and continues.
[0048] And position thetamr which was chosen by S314 and which can be locked is treated as a target angle of rotation, and the same processing as S108-S112 which were mentioned above is carried out in S316-S320 which are carried out henceforth.
[0049] By carrying out such lock control processing, since the rotation drive of the lock electrode holder 140 is carried out to the position which can be locked, the engagement heights 151 of the lock arm 150 are certainly inserted into the engagement crevice 141 of the lock electrode holder 140, and lock operation is ensured.
[0050] Moreover, lock control of S300 can also be carried out as shown in drawing 9 .
[0051] S330 [first,] -- electromagnetism -- after stopping energization of 154 to a coil, using the deflection Econst specified beforehand, a control signal Is is set up as Is=C(s) and Econst, and a motor 110 is driven S332 according to the control signal Is set up by S332 by S334
[0052] This deflection Econst is the value specified as angle deflection corresponding to the formation pitch of the engagement crevice 141 formed in the lock electrode holder 140, and lock operation is ensured, in order that the engagement crevice 141 of the lock electrode holder 140 may surely pass through the position which faces the engagement heights 151 of the lock arm 150, while the lock electrode holder 140 rotates by the formation pitch of the engagement crevice 141.
[0053] And it progresses after [S336] predetermined-time progress, angle-of-rotation thetam of the motor 110 in which the rotation position of the lock electrode holder 140 at this time is shown is read, and angle-of-rotation thetam read by S336 judges whether it is the position which was memorized beforehand and which can be locked in S338 continuing. By this judgment, in "Yes", since it can check

that lock operation with the lock electrode holder 140 and the lock arm 150 has been ensured, this routine is ended as it is. In "No", the lock electrode holder 140 and the lock arm 150 did not stop mutually by a certain cause by S338, but the lock electrode holder 140 passed the position which can be locked, and it rotated, or means that rotation had stopped before the position which can be locked. In such a case, the trouble indication lamp in which it progresses to S340 and failure of the lock mechanism 130 is shown is made to turn on, an operator is told about generating of failure, and this routine is ended.

[0054] In addition, when judged with "No" by judgment of S338, the processing after S330 can be repeated the number of predetermined times, and can be carried out, and it can also consider as a flow which progresses to S340 after that.

[0055] Although the lock electrode holder 140 and the lock arm 150 are illustrated as a lock mechanism 130 with the operation gestalt explained above, it does not limit to this configuration or arrangement state, and if it is the lock mechanism 130 which formed the crevice in one side and formed heights in another side, it will not limit especially.

[0056] Moreover, lock operation and lock release operation which were explained with the operation gestalt cannot be limited to the explained example, and can be applied also to lock operation and lock release operation which are carried out at the time of a rack stroke and a hit, and the fail of a system.

[0057]

[Effect of the Invention] Since lock control means perform [according to the steering control unit for vehicles concerning each claim] motion control of a motor in addition to the motion control of driving means as explained above, at the time of a lock rotation -- when it becomes possible to certainly make in agreement the physical relationship of the section of a member which can be stopped, and a tilting member and the bite lump has arisen between the tilting member and the rotation member at the time of lock release, it becomes possible to carry out control of which this bite lump is canceled in operating a motor Thus, it becomes possible to operate certainly the lock mechanism 130 of a transfer-ratio adjustable mechanism.

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the steering control unit for vehicles equipped with the transfer-ratio adjustable mechanism.

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PRIOR ART

[Description of the Prior Art] The steering control unit which carried from the former the transfer-ratio adjustable mechanism in which the transfer ratio between the steering angle of a steering handle and ****** of ******.was changed is known. For example, the steering control unit which equipped JP,11-34894,A with the lock mechanism which locks the differential mechanism in such a transfer-ratio adjustable mechanism is indicated. This lock mechanism is the mechanism in which the heights of the lock arm fixed to the motor housing side are stopped, to the crevice of the body of revolution fixed to the motor axis of rotation of a transfer-ratio adjustable mechanism.

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EFFECT OF THE INVENTION

[Effect of the Invention] Since lock control means perform [according to the steering control unit for vehicles concerning each claim] motion control of a motor in addition to the motion control of driving means as explained above, it is at the time of a lock. rotation -- when it becomes possible to certainly make in agreement the physical relationship of the section of a member which can be stopped, and a tilting member and the bite lump has arisen between the tilting member and the rotation member at the time of lock release, it becomes possible to carry out control of which this bite lump is canceled in operating a motor Thus, it becomes possible to operate certainly the lock mechanism 130 of a transfer-ratio adjustable mechanism.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Thus, since a lock mechanism was a mechanism with which a crevice and heights are made to engage, the physical relationship of the crevice of body of revolution and the heights of a lock arm was not in agreement, at the time of a lock, there may be no lock from skillful ****, and there was a case where there was no lock release in skillful ****, by the bite lump by the lock arm and body of revolution at it at the time of lock release.
[0004] this invention is made that such a technical problem should be solved, and the purpose is in offering the steering control unit for vehicles which may operate the lock mechanism of a transfer-ratio adjustable mechanism certainly.

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MEANS

[Means for Solving the Problem] Then, the steering control unit for vehicles concerning a claim 1 A transfer-ratio adjustable means to be the steering control unit for vehicles which performs steering control of vehicles, to have the output shaft connected with an input-shaft [which is connected with a steering handle side], and ****** side, and to change the transfer ratio between input-shaft-output shafts by the rotation drive of a motor, A rotation position detection means to detect the rotation position of a motor, and the tilting member supported free [tilting] to the stator side which constitutes a motor, The driving means to which a tilting member is made to tilt, and the rotation member which is fixed to Rota which constitutes a motor and has the section in which a tilting member and a stop are possible, and which can be stopped at intervals of predetermined, Motion control of a motor is performed with the motion control of driving means, and the lock control means which control a stop with a tilting member and a rotation member and stop release are had and constituted.
[0006] Although the lock and lock release of a differential mechanism in a transfer-ratio adjustable means are made by a stop with a tilting member and a rotation member, and stop release, in addition to the motion control of driving means, lock control means perform motion control of a motor in this case. thereby -- the time of a lock -- rotation -- when it becomes possible to certainly make in agreement the physical relationship of the section of a member which can be stopped, and a tilting member and the bite lump has arisen between the tilting member and the rotation member at the time of lock release, control of which this bite lump is canceled in operating a motor can be carried out
[0007] lock control means [in / a claim 1 / in the steering control unit for vehicles concerning a claim 2] -- a tilting member -- rotation -- a member -- the rotation detected by the tilting control means which make driving means drive so that it may tilt to a side, and the rotation position detection means -- the rotation position of a member and the rotation drive motor control / motor / means based on a position error with the section which can be stopped are had and constituted
[0008] tilting control means -- a tilting member -- rotation -- a member -- a rotation member is rotated by the motor control means to the section which can be stopped based on the position error which got mixed up with this control and was detected at the same time it makes it tilt in a side, i.e., the lock direction Thereby, a rotation member and a tilting member can be stopped certainly.
[0009] lock control means [in / a claim 1 / in the steering control unit for vehicles concerning a claim 3] -- a tilting member -- rotation -- a member -- the tilting control means which make driving means drive, and the motor control means which carries out the rotation drive of the motor at least more than the formation interval of the section which can be stopped are had and constituted so that it may tilt to a side
[0010] rotating a rotation member at least by the motor control means more than the formation interval of the section which can be stopped, after making a tilting member tilt in the lock direction by tilting control means -- rotation -- since the section of a member which can be stopped serves as the situation of surely passing through the position which faces a tilting member, a rotation member and a tilting member can be stopped certainly
[0011] When the rotation of the motor by which the lock control means in a claim 3 are obtained based

on the detection result of a rotation position detection means becomes more than the formation interval of the section which can be stopped, the steering control unit for vehicles concerning a claim 4 equips further the lock mechanism by the tilting member and the rotation member with a failure judging means judge it as what failure generated, and constitutes.
[0012] Although rotation of a motor will stop if a rotation member stops with a tilting member, when failure occurs in a lock mechanism, a tilting member and a rotation member do not stop mutually, but a motor continues rotation more than the formation interval of the section which can be stopped. This situation is judged by the failure judging means.
[0013] The steering control unit for vehicles concerning a claim 5 equips with and constitutes the tilting control means which make driving means drive, and a motor control means to make a motor reciprocate in the predetermined range so that a tilting member may estrange [the lock control means in a claim 1] from a rotation member.
[0014] Although a tilting member is made to tilt by tilting control means at the time of lock release so that it may estrange from a rotation member, a motor is made to reciprocate in the predetermined range by the motor control means at the time of this control processing. thereby -- a tilting member -- receiving -- rotation -- it will be in the state where the section of a member which can be stopped displaces in vibration, and it acts so that the bite lump between a tilting member and a rotation member may be canceled by this movement
[0015]
[Embodiments of the Invention] Hereafter, with reference to an accompanying drawing, it explains about the operation form of this invention.
[0016] The composition of the steering control unit which equipped drawing 1 with the transfer-ratio adjustable mechanism concerning the 1st operation form is shown.
[0017] The transfer-ratio adjustable mechanism 100 has the input shaft 20 connected with the steering handle 10 side, and the output shaft 40 connected with Wheel FW side, and has formed the steering angle sensor 60 which detects steering angle thetah of the steering handle 10 to the input shaft 20. Moreover, the output shaft 40 is connected with the rack shaft 51 through the gear equipment 50 of a rack-and-pinion formula, and Wheel FW is connected with the both sides of the rack shaft 51.
[0018] The transfer-ratio adjustable mechanism 100 is expanded and is roughly shown in drawing 2 . The transfer-ratio adjustable mechanism 100 is equipped with the motor 110, the reducer 120, and the lock mechanism 130, and has the function to change the transfer ratio of the rotation between the input-shaft 20-output shafts 40.
[0019] A motor 110 is equipped with the angle-of-rotation sensor 102 (refer to drawing 1) which detects angle-of-rotation thetam of a motor, and constitutes the servo motor which can control a rotation position while it is equipped with the stator 111 fixed in the motor housing 101, and Rota 112 supported free [rotation in the motor housing 101].
[0020] The reducer 120 constitutes the epicyclic gear mechanism and is fixing the sun gear 121 located in a core to the axis of rotation 113 rotated in one with Rota 112. Moreover, to it, the planetary gear 122 which revolves the circumference of a sun gear 121 around the sun is arranged at equal intervals, rotating around a sun gear 121, and each planetary gear 122 is supported free [rotation] with the carrier 123 connected with the input shaft 20. The starter ring 124 formed in the inner skin of the motor housing 101 is allotted, and the motor housing 101 is connected with an output shaft 40, and is constituted so that each planetary gear 122 may furthermore be surrounded.
[0021] Moreover, the part shown by the A-A line between a motor 110 and a reducer 120 is equipped with the lock mechanism 130 which locks the differential mechanism of a transfer-ratio adjustable mechanism. This lock mechanism 130 equips with and constitutes the lock electrode holder 140 of a disk configuration, and the lock arm 150 which curved circularly, as shown in drawing 3 .
[0022] It is fixed to the axis of rotation 113 which penetrates a core, and the lock electrode holder 140 rotates the lock electrode holder 140, the axis of rotation 113, and Rota 112 in one. Moreover, the engagement crevice 141 is formed in the periphery section of the lock electrode holder 140 at the predetermined intervals.

[0023] On the other hand, the lock arm 150 projects and forms in the lock electrode-holder 140 side the engagement heights 151 engaged in the engagement crevice 141 of the lock electrode holder 140. moreover, the end face section of the lock arm 150 is supported free [tilting] centering on the support pin 152 by the support pin 152 fixed to the motor housing 101 -- having -- **** -- the point of the lock arm 150 -- electromagnetism -- a coil 154 -- having -- this electromagnetism -- the metal plate (magnet board) 155 fixed to the position which faces a coil 154 at the motor housing 101 side is arranged Furthermore, the other end of the spring 153 which fixed the end to the motor housing 101 is being fixed to the point of the lock arm 150.
[0024] Thus, as the lock arm 150 is always energized by the operation of a spring 153 so that it may tilt to the lock electrode-holder 140 side centering on the support pin 152, and it is shown in drawing 3 , it will be in the state where the engagement heights 151 of the lock arm 150 enter in the engagement crevice 141 of the lock electrode holder 140, the lock electrode holder 140 and the lock arm 150 of each other are stopped, and, thereby, relative rotation with the motor housing 101 and Rota 112 is prevented. For this reason, the operation of the adjustable mechanism of a transfer ratio becomes impossible, and the transfer-ratio adjustable mechanism 100 will be in a lock state.
[0025] on the other hand -- electromagnetism -- if energized by the coil 154 -- between metal plates 155 -- electromagnetism -- as shown in drawing 4 , repulsive force [-like] occurs, the lock arm 150 is tilted so that it may estrange from the lock electrode holder 140, the engagement heights 151 of the lock arm 150 move out of the engagement crevice 141 of the lock electrode holder 140, and a stop with the lock electrode holder 140 and the lock arm 150 is canceled by the operation This will be in the state which the motor housing 101 and Rota 112 can relative rotate, and the transfer-ratio adjustable mechanism 100 is the mechanism canceled of a lock state.
[0026] If the angle of rotation of an output shaft 40 is set to output angle thetap here, since the relation of steering angle thetah, angle-of-rotation thetam of a motor 110, and output angle thetap will turn into a relation shown by (1) formula and the relation of steering angle thetah, output angle thetap, and a transfer ratio G will be prescribed by (2) formulas, (3) formulas can show angle-of-rotation thetam of a motor 110 from (1) formula and (2) formulas. In addition, "K" in a formula is the reduction gear ratio of a reducer 120.
[0027]
thetap=thetah+K-thetam -- (1)
thetap=G-thetah -- (2)
thetam=(G-1) -thetah/K -- (3)
Therefore, transfer-ratio control between the input-shaft 20-output shafts 40 can be performed by controlling angle-of-rotation thetam of a motor 110 according to steering angle thetah based on (3) formulas based on the set-up transfer ratio G. In addition, output angle thetap corresponds to the stroke position of the rack shaft 51, and further, since the stroke position of the rack shaft 51 corresponds to ****** of Wheel FW, it can detect output angle thetap from (1) formula by detecting steering angle thetah and angle-of-rotation thetam, and can detect ****** of Wheel FW based on this detected output angle thetap.
[0028] Thus, the transfer-ratio adjustable mechanism 100 to constitute and motion control of the lock mechanism 130 are carried out by the steering control unit 70, and based on each detection result of the steering angle sensor 60, the angle-of-rotation sensor 102, and the vehicle speed sensor 71, the steering control unit 70 outputs a control signal Is to a motor 110, and carries out drive control of the transfer-ratio adjustable mechanism 30. moreover -- the time of a lock and lock release -- electromagnetism -- predetermined control of the energization control to a coil 154 etc. is carried out
[0029] Here, the processing carried out with the steering control unit 70 is explained along with the flow chart of drawing 5 .
[0030] This flow chart starts by ON operation of an ignition switch. Since as for the inside of an OFF state the lock mechanism 130 of the transfer-ratio adjustable mechanism 100 operates and the ignition switch is in the lock state, first, it progresses to Step (a step is hereafter described as "S".) 200, and lock release control of which the lock state of the transfer-ratio adjustable mechanism 100 is canceled is

performed.
[0031] This lock release control is shown in the flow chart of drawing 6 .
[0032] first -- S202 -- electromagnetism -- energization is started in a coil 154 and driving force is given in the direction estranged from the lock electrode holder 140 to the lock arm 150
[0033] In S204 continuing, the predetermined control signal Istart1 specified beforehand is outputted to a motor 110. This control signal Istart1 is a control signal set up beforehand, in order to make a motor 110 reciprocate in vibration in the predetermined range, and sufficient range for the range made to reciprocate to cancel the bite lump by the engagement heights 151 of the lock arm 150 and the engagement crevice 141 of the lock electrode holder 140 is set up. And in S206 continuing, the angle of rotation thetam1 of the motor 110 at the time of ending processing of S204 is read.
[0034] In S208 continuing, the predetermined control signal Istart2 specified beforehand is outputted to a motor 110. This control signal Istart2 is a control signal beforehand set up so that the lock electrode holder 140 might rotate by the angle of rotation which serves as size from the formation width of face of the engagement crevice 141. And in S210 continuing, the angle of rotation thetam2 of the motor 110 at the time of ending processing of S208 is read.
[0035] The deflection delta of an angle of rotation thetam2 and an angle of rotation thetam1 is set up as delta=theta m2-thetam1, and it judges whether deflection delta is more than threshold deltath by S214 continuing S212 continuing. This threshold deltath is taken as the angle of rotation of the motor 110 corresponding to the formation width of face of the engagement crevice 141 in the lock electrode holder 140.
[0036] Consequently, when judged as "Yes" by S214, the lock electrode holder 140 is rotating more than the formation width of face of the engagement crevice 141, it can check that the stop with the lock arm 150 has been canceled by this, and this routine is ended as it is. On the other hand, when judged as "No" by S214, by some causes, such as a malfunction of a bite lump or the lock arm 150, can judge it as that by which stop release with the lock electrode holder 140 and the lock arm 150 was not carried out, progress to S216 in this case, the trouble indication lamp in which failure of the lock mechanism 130 is shown is made to turn on, an operator is told about generating of failure, and this routine is ended.
[0037] Thus, immediately after ON operation of an ignition switch, lock release control shown by S202-S216 is performed. In addition, especially the order of processing of S202 and S204 may not limit, and may be performed simultaneously.
[0038] It progresses to S102, after returning to drawing 5 again and performing lock release control (S200). In S102, the vehicle speed V detected by steering angle thetah detected by the steering angle sensor 60, angle-of-rotation thetam of the motor 110 detected by the angle-of-rotation sensor 102, and the vehicle speed sensor 71 is read, respectively.
[0039] continuing -- S -- 104 -- **** -- drawing 7 -- being shown -- the vehicle speed -- V -- a transfer ratio -- G -- a relation -- being shown -- a map -- from -- S -- 102 -- having read -- the vehicle speed -- V -- a basis -- a map -- reference -- carrying out -- the vehicle speed -- V -- having responded -- a transfer ratio -- G -- setting up -- continuing -- S -- 106 -- **** -- the above -- (-- three --) -- a formula -- using -- S -- 102 -- having read
[0040] In S108 continuing, the angle deflection e of target angle-of-rotation thetamm set up by S106 and angle-of-rotation thetam read by S102 is set up as e=thetamm-thetam.
[0041] In S110 continuing, without overshooting, the control signal Is which controls a motor 110 is determined so that deflection e may be set to 0. As an example of this processing, a control signal Is can be determined by setting up the parameter of PID control appropriately based on the operation expression of Is=C(s) and e. In addition, (s) in a formula is the Laplacian operator.
[0042] Processing after S102 mentioned above is repeated and performed until output the control signal Is determined by S110 to a motor 110 in S112 continuing, drive a motor 110 according to a control signal Is, it progresses to S114 after this, and it judges whether OFF operation of the ignition switch (IG) was carried out, and returns S102 in "No" and is judged as "Yes" by S114.
[0043] And when OFF operation of the ignition switch is carried out, it progresses to "Yes") and S300 by (S114, and lock control which locks the transfer-ratio adjustable mechanism 100 is performed.

[0044] This lock control is shown in the flow chart of drawing 8 .
[0045] S310 -- first -- electromagnetism -- the energization to a coil 154 is stopped This tilts the lock arm 150 to the lock electrode-holder 140 side centering on the support pin 152 according to the stability of a spring 153.
[0046] In S312 continuing, angle-of-rotation thetam of the motor 110 in which the rotation position of the lock electrode holder 140 at this time is shown is read.
[0047] The lock electrode holder 140 chooses as the steering control unit 70 nearby position thetamr which can be locked to angle-of-rotation thetam read by S312 by S314 which is made to memorize beforehand the rotation position in which the lock arm 150 and a lock are possible, and continues.
[0048] And position thetamr which was chosen by S314 and which can be locked is treated as a target angle of rotation, and the same processing as S108-S112 which were mentioned above is carried out in S316-S320 which are carried out henceforth.
[0049] By carrying out such lock control processing, since the rotation drive of the lock electrode holder 140 is carried out to the position which can be locked, the engagement heights 151 of the lock arm 150 are certainly inserted into the engagement crevice 141 of the lock electrode holder 140, and lock operation is ensured.
[0050] Moreover, lock control of S300 can also be carried out as shown in drawing 9 .
[0051] S330 [first,] -- electromagnetism -- after stopping energization of 154 to a coil, using the deflection Econst specified beforehand, a control signal Is is set up as Is=C(s) and Econst, and a motor 110 is driven S332 according to the control signal Is set up by S332 by S334
[0052] This deflection Econst is the value specified as angle deflection corresponding to the formation pitch of the engagement crevice 141 formed in the lock electrode holder 140, and lock operation is ensured, in order that the engagement crevice 141 of the lock electrode holder 140 may surely pass through the position which faces the engagement heights 151 of the lock arm 150, while the lock electrode holder 140 rotates by the formation pitch of the engagement crevice 141.
[0053] And it progresses after [S336] predetermined-time progress, angle-of-rotation thetam of the motor 110 in which the rotation position of the lock electrode holder 140 at this time is shown is read, and angle-of-rotation thetam read by S336 judges whether it is the position which was memorized beforehand and which can be locked in S338 continuing. By this judgment, in "Yes", since it can check that lock operation with the lock electrode holder 140 and the lock arm 150 has been ensured, this routine is ended as it is. In "No", the lock electrode holder 140 and the lock arm 150 did not stop mutually by a certain cause by S338, but the lock electrode holder 140 passed the position which can be locked, and it rotated, or means that rotation had stopped before the position which can be locked. In such a case, the trouble indication lamp in which it progresses to S340 and failure of the lock mechanism 130 is shown is made to turn on, an operator is told about generating of failure, and this routine is ended.
[0054] In addition, when judged with "No" by judgment of S338, the processing after S330 can be repeated the number of predetermined times, and can be carried out, and it can also consider as a flow which progresses to S340 after that.
[0055] Although the lock electrode holder 140 and the lock arm 150 are illustrated as a lock mechanism 130 with the operation form explained above, it does not limit to this configuration or arrangement state, and if it is the lock mechanism 130 which formed the crevice in one side and formed heights in another side, it will not limit especially.
[0056] Moreover, lock operation and lock release operation which were explained with the operation form cannot be limited to the explained example, and can be applied also to lock operation and lock release operation which are carried out at the time of a rack stroke and a hit, and the fail of a system.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the composition of the steering control unit concerning an operation gestalt.
[Drawing 2] It is the cross section showing a transfer-ratio adjustable mechanism.
[Drawing 3] In the A-A line cross section in drawing 2 , it is the plan of the lock mechanism which shows a lock state.
[Drawing 4] In the A-A line cross section in drawing 2 , it is the plan of the lock mechanism which shows a lock release state.
[Drawing 5] It is the flow chart which shows adjustable control of a transfer ratio.
[Drawing 6] It is the flow chart which shows lock release control.
[Drawing 7] It is the map which specified the relation between the vehicle speed V and a transfer ratio G.
[Drawing 8] It is the flow chart which shows lock control.
[Drawing 9] It is the flow chart which shows lock control.
[Description of Notations]
FW [-- Transfer-ratio adjustable mechanism] -- A wheel (******), 10 -- A steering handle, 100
102 [-- Stator] -- An angle-of-rotation sensor, 110 -- A motor, 111
112 [-- A lock mechanism 140 / -- A lock electrode holder (rotation member), 141 / -- Engagement crevice (section which can be stopped)] -- Rota, 120 -- A reducer, 130
150 -- Lock arm (tilting member)

[Translation done.]

* NOTICES *

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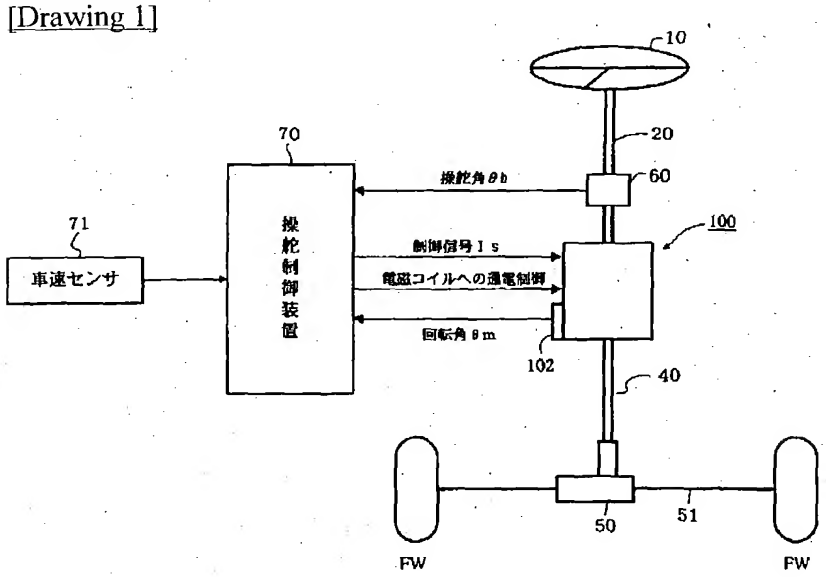
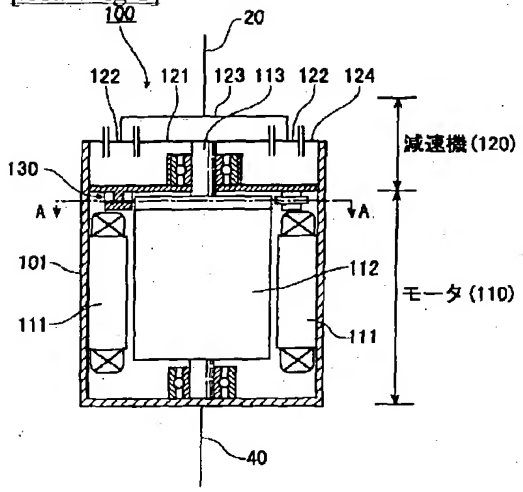
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

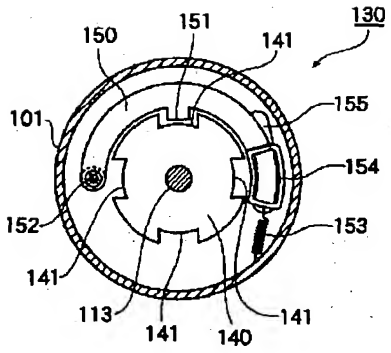
[Drawing 1]



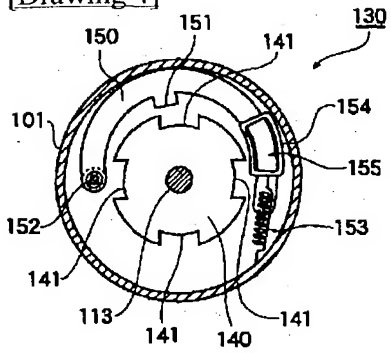
[Drawing 2]



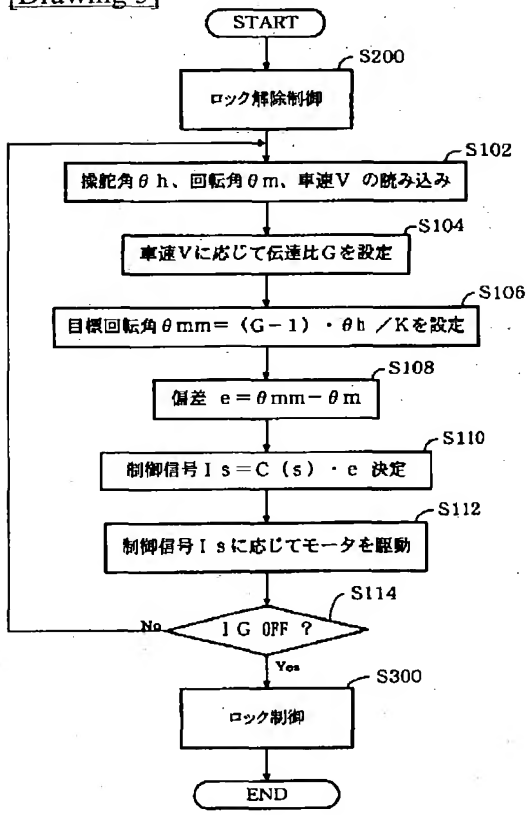
[Drawing 3]



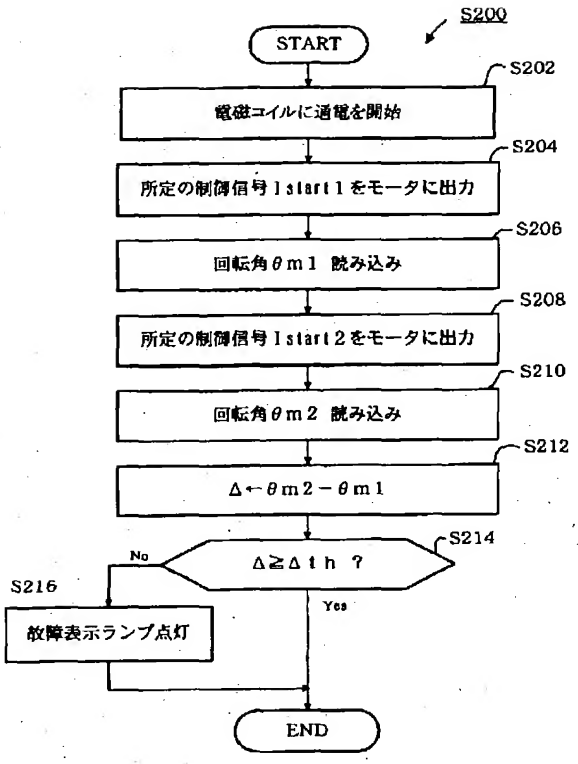
[Drawing 4]



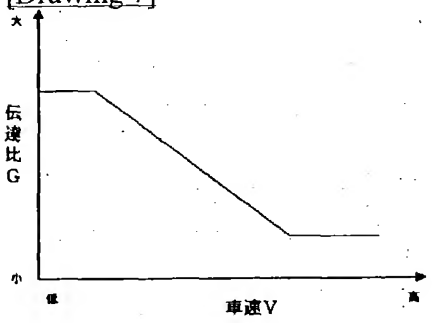
[Drawing 5]



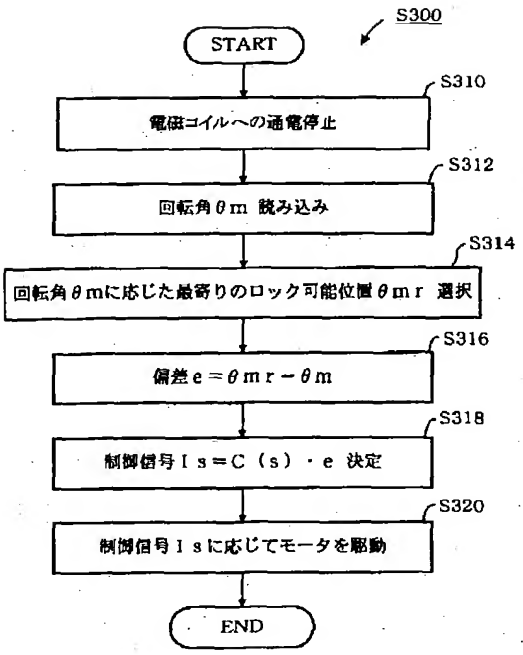
[Drawing 6]



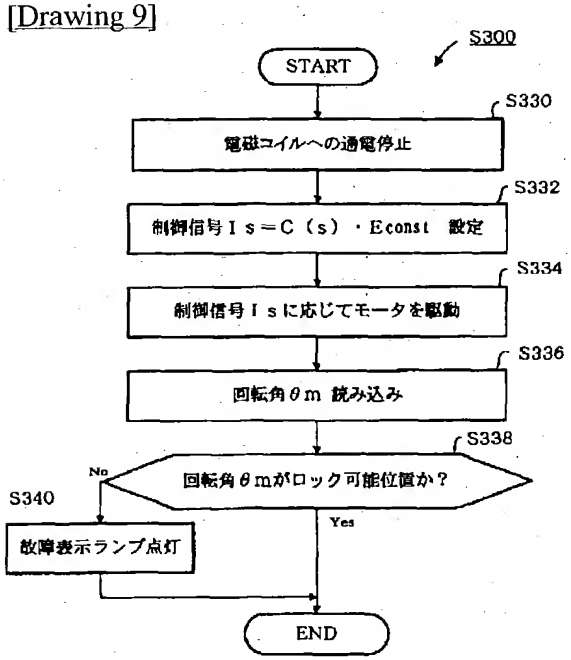
[Drawing 7]



[Drawing 8]



[Drawing 9]



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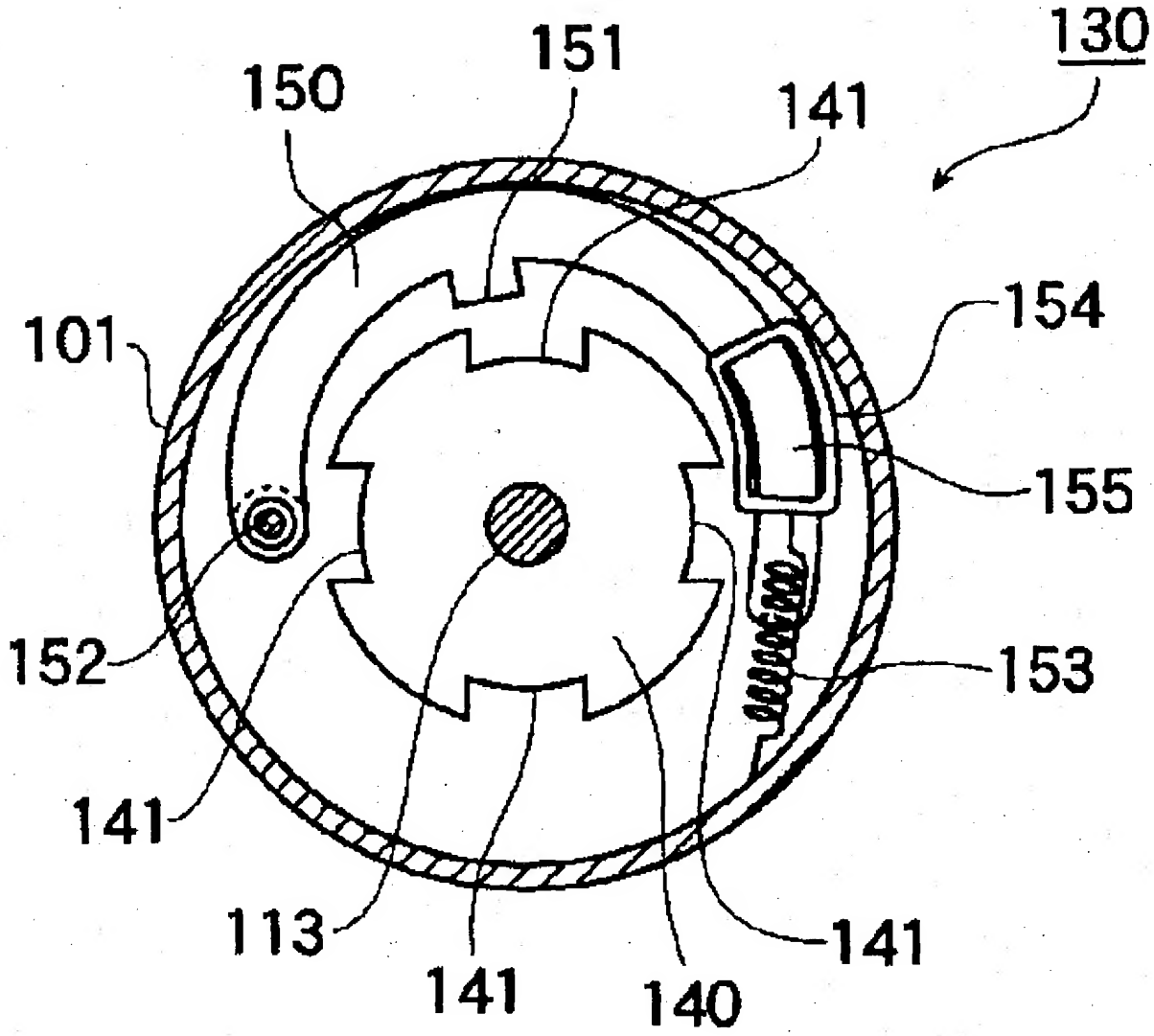
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5/04			5/04	３Ｄ０３３
// Ｂ６２Ｄ 101:00				
113:00				

審査請求　未請求　請求項の数５　ＯＬ　（全　８　頁）

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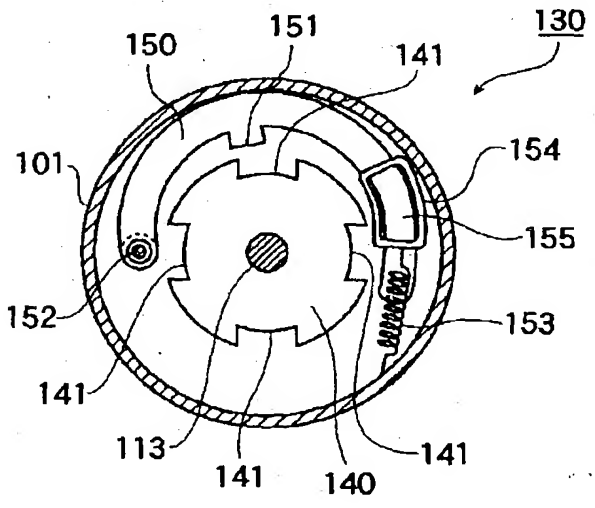
最終頁に続く

(54)【発明の名称】　車両用操舵制御装置

(57)【要約】
【課題】伝達比可変機構のロック機構がロックアームの凸部をロックホルダの凹部内に嵌合させる構造であり、位置偏差が生じてロックが掛からず、噛み込みによりロック解除ができない場合があった。
【解決手段】　ロック時にはロックホルダ１４０を最寄りのロック可能位置まで回転させ、ロック解除時にはロックホルダ１４０を振動的に往復動させて噛み込みを解除する。



【特許請求の範囲】
【請求項１】　車両の操舵制御を行う車両用操舵制御装置であって、
操舵ハンドル側に連結される入力軸と転舵輪側に連結される出力軸とを有し、モータの回転駆動により入力軸－出力軸間の伝達比を変化させる伝達比可変手段と、
前記モータの回転位置を検出する回転位置検出手段と、
前記モータを構成するステータ側に対し、傾動自在に支持された傾動部材と、
前記傾動部材を傾動させる駆動手段と、
前記モータを構成するロータに対して固定され、前記傾動部材と係止可能な係止可能部を所定間隔で有する回転部材と、
前記駆動手段の動作制御と共にモータの動作制御を行い、前記傾動部材と回転部材との係止及び係止解除を制御するロック制御手段とを備える車両用操舵制御装置。
【請求項２】　前記ロック制御手段は、
前記傾動部材が回転部材側に傾動するように、前記駆動手段を駆動させる傾動制御手段と、
前記回転位置検出手段によって検出された前記回転部材の回転位置と、前記係止可能部との位置偏差をもとに、前記モータを回転駆動するモータ制御手段とを備える請求項１記載の車両用操舵制御装置。
【請求項３】　前記ロック制御手段は、
前記傾動部材が回転部材側に傾動するように、前記駆動手段を駆動させる傾動制御手段と、
少なくとも前記係止可能部の形成間隔以上に、前記モータを回転駆動するモータ制御手段とを備える請求項１記載の車両用操舵制御装置。
【請求項４】　前記ロック制御手段は、
前記回転位置検出手段の検出結果をもとに得られる前記モータの回転量が、前記係止可能部の形成間隔以上となった場合に、前記傾動部材と回転部材とによるロック機構に故障が発生したものと判断する故障判定手段をさらに備える請求項３記載の車両用操舵制御装置。
【請求項５】　前記ロック制御手段は、
前記傾動部材が前記回転部材から離間するように、前記駆動手段を駆動させる傾動制御手段と、
前記モータを所定範囲で往復動させるモータ制御手段とを備える請求項１記載の車両用操舵制御装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、伝達比可変機構を備えた車両用操舵制御装置に関する。
【０００２】
【従来の技術】従来から、操舵ハンドルの操舵角と転舵輪の転舵角との間の伝達比を変化させる伝達比可変機構を搭載した操舵制御装置が知られている。例えば特開平１１－３４８９４号には、このような伝達比可変機構における差動機構をロックするロック機構を備えた操舵制御装置が開示されている。このロック機構は、伝達比可変機構のモータ回転軸に固定した回転体の凹部に対し、モータハウジング側に固定したロックアームの凸部を係止させる機構となっている。
【０００３】
【発明が解決しようとする課題】このようにロック機構が、凹部と凸部とを係合させる機構であるため、ロック時には、回転体の凹部とロックアームの凸部との位置関係が一致せず、ロックが上手く掛からない場合があり、またロック解除時には、ロックアームと回転体との噛み込みにより、ロック解除が上手く行かない場合があった。
【０００４】本発明はこのような課題を解決すべくなされたものであり、その目的は、伝達比可変機構のロック機構を確実に動作させ得る車両用操舵制御装置を提供することにある。
【０００５】
【課題を解決するための手段】そこで、請求項１にかかる車両用操舵制御装置は、車両の操舵制御を行う車両用操舵制御装置であって、操舵ハンドル側に連結される入力軸と転舵輪側に連結される出力軸とを有し、モータの回転駆動により入力軸－出力軸間の伝達比を変化させる伝達比可変手段と、モータの回転位置を検出する回転位置検出手段と、モータを構成するステータ側に対し、傾動自在に支持された傾動部材と、傾動部材を傾動させる駆動手段と、モータを構成するロータに対して固定され、傾動部材と係止可能な係止可能部を所定間隔で有する回転部材と、駆動手段の動作制御と共にモータの動作制御を行い、傾動部材と回転部材との係止及び係止解除を制御するロック制御手段とを備えて構成する。
【０００６】傾動部材と回転部材との係止及び係止解除により、伝達比可変手段における差動機構のロック及びロック解除がなされるが、この際、ロック制御手段によって、駆動手段の動作制御に加え、モータの動作制御を行う。これにより、ロック時には、回転部材の係止可能部と傾動部材との位置関係を確実に一致させることが可能となり、またロック解除時に、傾動部材と回転部材との間に噛み込みが生じている場合にも、モータを動作させることでこの噛み込みを解除するような制御を実施し得る。
【０００７】請求項２にかかる車両用操舵制御装置は、請求項１におけるロック制御手段が、傾動部材が回転部材側に傾動するように駆動手段を駆動させる傾動制御手段と、回転位置検出手段によって検出された回転部材の回転位置と、係止可能部との位置偏差をもとに、モータを回転駆動するモータ制御手段とを備えて構成する。
【０００８】傾動制御手段によって傾動部材を回転部材側、すなわちロック方向に傾動させると同時に或いはこの制御と前後して、検出した位置偏差をもとに、モータ制御手段によって回転部材を係止可能部まで回転させ

る。これにより、回転部材と傾動部材とを確実に係止させることができる。

【０００９】請求項３にかかる車両用操舵制御装置は、請求項１におけるロック制御手段が、傾動部材が回転部材側に傾動するように、駆動手段を駆動させる傾動制御手段と、少なくとも係止可能部の形成間隔以上に、モータを回転駆動するモータ制御手段とを備えて構成する。

【００１０】傾動制御手段によって傾動部材をロック方向に傾動させた後、モータ制御手段によって回転部材を少なくとも係止可能部の形成間隔以上に回転させることで、回転部材の係止可能部が、傾動部材と相対する位置を必ず通過する状況となるので、回転部材と傾動部材とを確実に係止させることができる。

【００１１】請求項４にかかる車両用操舵制御装置は、請求項３におけるロック制御手段が、回転位置検出手段の検出結果をもとに得られるモータの回転量が、係止可能部の形成間隔以上となった場合に、傾動部材と回転部材とによるロック機構に故障が発生したものと判断する故障判定手段をさらに備えて構成する。

【００１２】回転部材が傾動部材と係止するとモータの回転が停止するが、ロック機構に故障が発生した場合には、傾動部材と回転部材とが互いに係止せず、係止可能部の形成間隔以上にモータが回転を続ける。この状況を故障判定手段によって判定する。

【００１３】請求項５にかかる車両用操舵制御装置は、請求項１におけるロック制御手段が、傾動部材が回転部材から離間するように、駆動手段を駆動させる傾動制御手段と、モータを所定範囲で往復動させるモータ制御手段とを備えて構成する。

【００１４】ロック解除時には、回転部材から離間するように、傾動制御手段によって傾動部材を傾動させるが、この制御処理時に、モータ制御手段によってモータを所定範囲で往復動させる。これにより、傾動部材に対して、回転部材の係止可能部が振動的に変位する状態となり、この動きにより、傾動部材と回転部材との間の噛み込みが解除されるように作用する。

【００１５】

【発明の実施の形態】以下、本発明の実施形態につき、添付図面を参照して説明する。

【００１６】図１に第１の実施形態にかかる伝達比可変機構を備えた操舵制御装置の構成を示す。

【００１７】伝達比可変機構１００は、操舵ハンドル１０側に連結された入力軸２０と、車輪ＦＷ側に連結された出力軸４０とを有しており、入力軸２０に対し、操舵ハンドル１０の操舵角θhを検出する操舵角センサ６０を設けている。また、出力軸４０は、ラックアンドピニオン式のギヤ装置５０を介してラック軸５１に連結されており、ラック軸５１の両側には車輪ＦＷが連結されている。

【００１８】図２に、伝達比可変機構１００を拡大して概略的に示す。伝達比可変機構１００は、モータ１１０、減速機１２０、ロック機構１３０を備えており、入力軸２０－出力軸４０間の回転量の伝達比を変化させる機能を有している。

【００１９】モータ１１０は、モータハウジング１０１内に固定したステータ１１１と、モータハウジング１０１内に回転自在に支持されたロータ１１２とを備えると共に、モータの回転角θmを検出する回転角センサ１０２（図１参照）を備えており、回転位置を制御可能なサーボモータを構成している。

【００２０】減速機１２０は遊星歯車機構を構成しており、中心部に位置するサンギヤ１２１は、ロータ１１２と一体的に回転する回転軸１１３に固定している。また、サンギヤ１２１の周囲には、自転しつつサンギヤ１２１の周囲を公転するプラネタリギヤ１２２を等間隔で配置し、各プラネタリギヤ１２２は、入力軸２０に連結されたキャリア１２３によって自転自在に支持されている。さらに各プラネタリギヤ１２２を囲むように、モータハウジング１０１の内周面に形成したリングギヤ１２４を配し、モータハウジング１０１を出力軸４０に連結して構成している。

【００２１】また、モータ１１０と減速機１２０との間における、Ａ－Ａ線で示す部位には、伝達比可変機構の差動機構をロックするロック機構１３０を備えている。このロック機構１３０は、図３に示すように、円盤形状のロックホルダ１４０と円弧状に湾曲したロックアーム１５０とを備えて構成している。

【００２２】ロックホルダ１４０は、中心部を貫通する回転軸１１３に固定されており、ロックホルダ１４０、回転軸１１３及びロータ１１２は一体的に回転する。また、ロックホルダ１４０の周縁部には、所定の間隔で係合凹部１４１を形成している。

【００２３】これに対し、ロックアーム１５０は、ロックホルダ１４０の係合凹部１４１内に係合する係合凸部１５１を、ロックホルダ１４０側に突出形成している。また、ロックアーム１５０の基端部は、モータハウジング１０１に固定した支持ピン１５２によって、支持ピン１５２を中心に傾動自在に支持されており、ロックアーム１５０の先端部には、電磁コイル１５４を備え、この電磁コイル１５４と相対する位置に、モータハウジング１０１側に固定した金属板（磁石板）１５５を配置している。さらに、ロックアーム１５０の先端部には、一端をモータハウジング１０１に固定したスプリング１５３の他端が固定されている。

【００２４】このようにロックアーム１５０は、スプリング１５３の作用によって、支持ピン１５２を中心としてロックホルダ１４０側に傾動するように常時付勢されており、図３に示すように、ロックホルダ１４０の係合凹部１４１内にロックアーム１５０の係合凸部１５１が入り込む状態となって、ロックホルダ１４０とロックア

ーム１５０とが互いに係止され、これによりモータハウジング１０１とロータ１１２との相対回転が阻止される。このため、伝達比の可変機構が作動不可能となり、伝達比可変機構１００がロック状態となる。

【００２５】一方、電磁コイル１５４に通電されると、金属板１５５との間に電磁的な反発力が発生し、その作用によって、図４に示すように、ロックアーム１５０はロックホルダ１４０から離間するように傾動し、ロックアーム１５０の係合凸部１５１は、ロックホルダ１４０の係合凹部１４１の外に移動し、ロックホルダ１４０とロックアーム１５０との係止が解除される。これによりモータハウジング１０１とロータ１１２とは、相対回転が可能な状態となり、伝達比可変機構１００がロック状態から解除される機構となっている。

【００２６】ここで出力軸４０の回転角を出力角θｐとすると、操舵角θｈ、モータ１１０の回転角θｍ、出力角θｐの関係は（１）式で示す関係となり、操舵角θｈ、出力角θｐ、伝達比Ｇの関係は（２）式で規定されるため、（１）式及び（２）式より、モータ１１０の回転角θｍは（３）式で示すことができる。なお、式中の「Ｋ」は減速機１２０の減速比である。

【００２７】

θｐ＝θｈ＋Ｋ・θｍ　…（１）

θｐ＝Ｇ・θｈ　…（２）

θｍ＝（Ｇ－１）・θｈ／Ｋ　…（３）

従って（３）式に基づいて、設定された伝達比Ｇをもとに操舵角θｈに応じてモータ１１０の回転角θｍを制御することで、入力軸２０－出力軸４０間の伝達比制御を行うことができる。なお、出力角θｐは、ラック軸５１のストローク位置に対応し、さらにラック軸５１のストローク位置は車輪ＦＷの転舵角に対応するため、操舵角θｈ及び回転角θｍを検出することで（１）式より出力角θｐを検知することができ、この検知した出力角θｐをもとに車輪ＦＷの転舵角が検知可能となっている。

【００２８】このように構成する伝達比可変機構１００及びそのロック機構１３０の動作制御は操舵制御装置７０によって実施され、操舵制御装置７０は、操舵角センサ６０、回転角センサ１０２及び車速センサ７１の各検出結果をもとに、モータ１１０に対して制御信号Ｉｓを出力して伝達比可変機構３０の駆動制御を実施する。また、ロック時及びロック解除時には、電磁コイル１５４に対する通電制御等の所定の制御を実施する。

【００２９】ここで、操舵制御装置７０で実施される処理について、図５のフローチャートに沿って説明する。

【００３０】このフローチャートはイグニションスイッチのオン操作によって起動する。イグニションスイッチがオフ状態中は、伝達比可変機構１００のロック機構１３０が作動しロック状態となっているため、まず、ステップ（以下、ステップを「Ｓ」と記す。）２００に進み、伝達比可変機構１００のロック状態を解除するロック解除制御を実行する。

【００３１】このロック解除制御を図６のフローチャートに示す。

【００３２】まずＳ２０２では、電磁コイル１５４に通電を開始して、ロックアーム１５０に対して、ロックホルダ１４０から離間する方向へ駆動力を与える。

【００３３】続くＳ２０４では、予め規定した所定の制御信号Ｉstart1をモータ１１０に出力する。この制御信号Ｉstart1は、モータ１１０を所定の範囲で振動的に往復動させるために予め設定した制御信号であり、往復動させる範囲は、ロックアーム１５０の係合凸部１５１と、ロックホルダ１４０の係合凹部１４１との噛み込みを解除するに十分な範囲が設定されている。そして続くＳ２０６では、Ｓ２０４の処理を終了した時点におけるモータ１１０の回転角θｍ１を読み込む。

【００３４】続くＳ２０８では、予め規定した所定の制御信号Ｉstart2をモータ１１０に出力する。この制御信号Ｉstart2は、例えば係合凹部１４１の形成幅よりも大となる回転角でロックホルダ１４０が回転するように予め設定した制御信号である。そして続くＳ２１０では、Ｓ２０８の処理を終了した時点におけるモータ１１０の回転角θｍ２を読み込む。

【００３５】続くＳ２１２では、回転角θｍ２と回転角θｍ１との偏差Δを Δ＝θｍ２－θｍ１として設定し、続くＳ２１４では偏差Δがしきい値Δth以上であるかを判断する。このしきい値Δthは、例えばロックホルダ１４０における係合凹部１４１の形成幅に対応するモータ１１０の回転角とする。

【００３６】その結果、Ｓ２１４で「Ｙｅｓ」と判断された場合には、ロックホルダ１４０がその係合凹部１４１の形成幅以上に回転しており、これによりロックアーム１５０との係止が解除されたことが確認でき、このままこのルーチンを終了する。これに対し、Ｓ２１４で「Ｎｏ」と判断された場合には、噛み込みやロックアーム１５０の動作不良等、何らかの原因で、ロックホルダ１４０とロックアーム１５０との係止解除が遂行されなかったものと判断でき、この場合にはＳ２１６に進んで、ロック機構１３０の故障を示す故障表示ランプを点灯させ、運転者に故障の発生を知らせこのルーチンを終了する。

【００３７】このように、イグニションスイッチのオン操作直後には、Ｓ２０２～Ｓ２１６で示したロック解除制御を実行する。なお、Ｓ２０２とＳ２０４の処理順は、特に限定するものではなく、同時に実行しても良い。

【００３８】再び図５に戻り、ロック解除制御（Ｓ２００）を実行した後、Ｓ１０２に進む。Ｓ１０２では、操舵角センサ６０で検出された操舵角θｈ、回転角センサ１０２で検出されたモータ１１０の回転角θｍ、車速センサ７１で検出された車速Ｖをそれぞれ読み込む。

【００３９】続くＳ１０４では、図７に示す車速Ｖと伝達比Ｇとの関係を示すマップから、Ｓ１０２で読み込んだ車速Ｖをもとにマップ検索し、車速Ｖに応じた伝達比Ｇを設定し、続くＳ１０６では、前出の（３）式を用い、Ｓ１０２で読み込んだ操舵角θｈ及びＳ１０４で設定した伝達比Ｇをもとに、モータ１１０の目標回転角θｍｍを設定する。

【００４０】続くＳ１０８では、Ｓ１０６で設定された目標回転角θｍｍと、Ｓ１０２で読み込まれた回転角θｍとの角度偏差ｅを、ｅ＝θｍｍ－θｍとして設定する。

【００４１】続くＳ１１０では、オーバーシュートすることなく偏差ｅを０にするように、モータ１１０を制御する制御信号Ｉｓを決定する。この処理の一例としては、Ｉｓ＝Ｃ（ｓ）・ｅの演算式に基づいて、ＰＩＤ制御のパラメータを適切に設定することにより制御信号Ｉｓを決定することができる。なお、式中の（ｓ）はラプラス演算子である。

【００４２】続くＳ１１２では、Ｓ１１０で決定された制御信号Ｉｓをモータ１１０に出力し、制御信号Ｉｓに応じてモータ１１０を駆動し、この後Ｓ１１４に進み、イグニションスイッチ（ＩＧ）がオフ操作されたかを判断し、「Ｎｏ」の場合にはＳ１０２に戻り、Ｓ１１４で「Ｙｅｓ」と判断されるまで、前述したＳ１０２以降の処理を繰り返し実行する。

【００４３】そして、イグニションスイッチがオフ操作された場合には（Ｓ１１４で「Ｙｅｓ」）、Ｓ３００に進み、伝達比可変機構１００をロックするロック制御を実行する。

【００４４】このロック制御を図８のフローチャートに示す。

【００４５】Ｓ３１０では、まず電磁コイル１５４への通電を停止する。これによりロックアーム１５０は、スプリング１５３の復元力によって、支持ピン１５２を中心にロックホルダ１４０側へ傾動する。

【００４６】続くＳ３１２ではこのときのロックホルダ１４０の回転位置を示すモータ１１０の回転角θｍを読み込む。

【００４７】操舵制御装置７０には、ロックホルダ１４０がロックアーム１５０とロック可能な回転位置を予め記憶させており、続くＳ３１４では、Ｓ３１２で読み込んだ回転角θｍに対し、最寄りのロック可能位置θｍｒを選択する。

【００４８】そして、以降に実施されるＳ３１６～Ｓ３２０では、Ｓ３１４で選択したロック可能位置θｍｒを目標回転角として扱い、前述したＳ１０８～Ｓ１１２と同様の処理を実施する。

【００４９】このようなロック制御処理を実施することで、ロックホルダ１４０がロック可能位置まで回転駆動されるため、ロックアーム１５０の係合凸部１５１がロックホルダ１４０の係合凹部１４１内に確実に挿入され、ロック動作が確実に行われる。

【００５０】また、Ｓ３００のロック制御は、図９に示すように実施することもできる。

【００５１】まず、Ｓ３３０で電磁コイルへ１５４の通電を停止した後、Ｓ３３２では予め規定した偏差Ｅｃｏｎｓｔを用いて、制御信号ＩｓをＩｓ＝Ｃ（ｓ）・Ｅｃｏｎｓｔとして設定し、Ｓ３３４ではＳ３３２で設定した制御信号Ｉｓに応じてモータ１１０を駆動する。

【００５２】この偏差Ｅｃｏｎｓｔは、ロックホルダ１４０に形成された係合凹部１４１の形成ピッチに対応する角度偏差として規定した値であり、ロックホルダ１４０が係合凹部１４１の形成ピッチ分だけ回転する間に、ロックホルダ１４０の係合凹部１４１がロックアーム１５０の係合凸部１５１に相対する位置を必ず通過するため、ロック動作が確実に行われるものである。

【００５３】そして所定時間経過後Ｓ３３６に進み、このときのロックホルダ１４０の回転位置を示すモータ１１０の回転角θｍを読み込み、続くＳ３３８では、Ｓ３３６で読み込んだ回転角θｍが予め記憶したロック可能位置であるかを判断する。この判断で「Ｙｅｓ」の場合には、ロックホルダ１４０とロックアーム１５０とのロック動作が確実に行われたことが確認できるため、このままこのルーチンを終了する。Ｓ３３８で「Ｎｏ」の場合には、何らかの原因でロックホルダ１４０とロックアーム１５０とが互いに係止せず、ロックホルダ１４０がロック可能位置を過ぎて回転したか或いはロック可能位置の手前で回転が停止したことになる。このような場合には、Ｓ３４０に進みロック機構１３０の故障を示す故障表示ランプを点灯させ、運転者に故障の発生を知らせこのルーチンを終了する。

【００５４】なお、Ｓ３３８の判断で「Ｎｏ」と判定された場合には、Ｓ３３０以降の処理を所定回数繰り返して実施し、その後、Ｓ３４０に進むようなフローとすることもできる。

【００５５】以上説明した実施形態では、ロック機構１３０としてロックホルダ１４０とロックアーム１５０とを例示したが、この形状や配置状態に限定するものではなく、一方に凹部、他方に凸部を形成したロック機構１３０であれば、特に限定するものではない。

【００５６】また、実施形態で説明したロック動作及びロック解除動作は、説明した例に限定するものではなく、例えば、ラックストロークエンド当たり時やシステムのフェイル時に実施されるロック動作及びロック解除動作にも適用することができる。

【００５７】

【発明の効果】以上説明したように、各請求項にかかる車両用操舵制御装置によれば、ロック制御手段によって、駆動手段の動作制御に加え、モータの動作制御を行うので、ロック時には、回転部材の係止可能部と傾動部

材との位置関係を確実に一致させることが可能となり、またロック解除時に、傾動部材と回転部材との間に噛み込みが生じている場合にも、モータを動作させることでこの噛み込みを解除するような制御を実施することが可能となる。このように、伝達比可変機構のロック機構１３０を確実に動作させることが可能となる。

【図面の簡単な説明】

【図１】実施形態にかかる操舵制御装置の構成を示すブロック図である。

【図２】伝達比可変機構を示す断面図である。

【図３】図２におけるＡ－Ａ線断面において、ロック状態を示すロック機構の平面図である。

【図４】図２におけるＡ－Ａ線断面において、ロック解除状態を示すロック機構の平面図である。

【図５】伝達比の可変制御を示すフローチャートである。

【図６】ロック解除制御を示すフローチャートである。

【図７】車速Ｖと伝達比Ｇとの関係を規定したマップである。

【図８】ロック制御を示すフローチャートである。

【図９】ロック制御を示すフローチャートである。

【符号の説明】

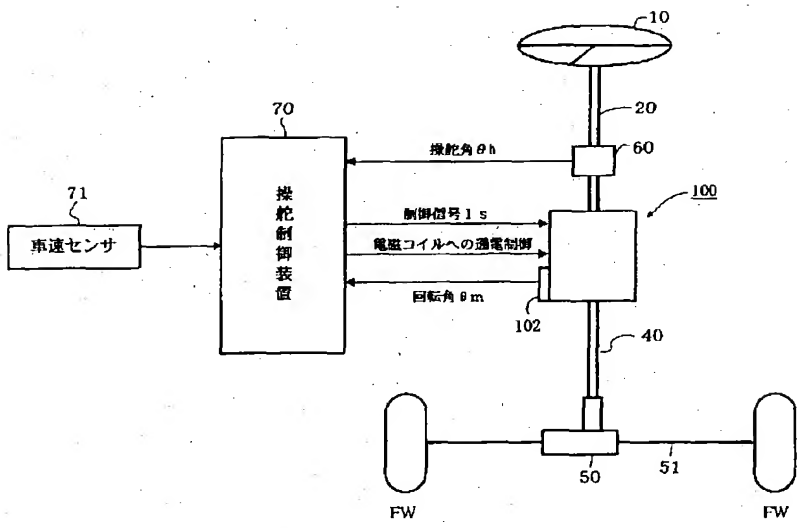
ＦＷ…車輪（転舵輪）、１０…操舵ハンドル、１００…伝達比可変機構

１０２…回転角センサ、１１０…モータ、１１１…ステータ

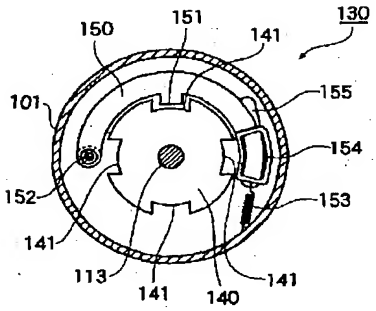
１１２…ロータ、１２０…減速機、１３０…ロック機構、１４０…ロックホルダ（回転部材）、１４１…係合凹部（係止可能部）

１５０…ロックアーム（傾動部材）

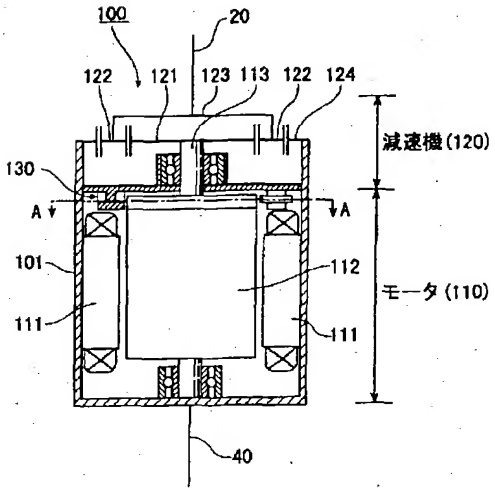
【図１】



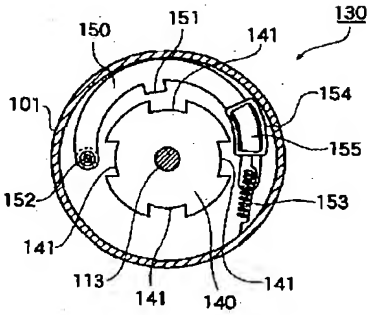
【図３】



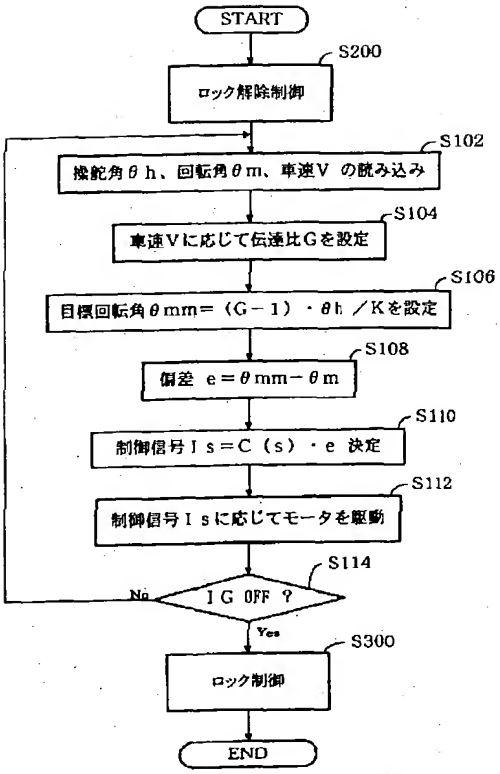
【図２】



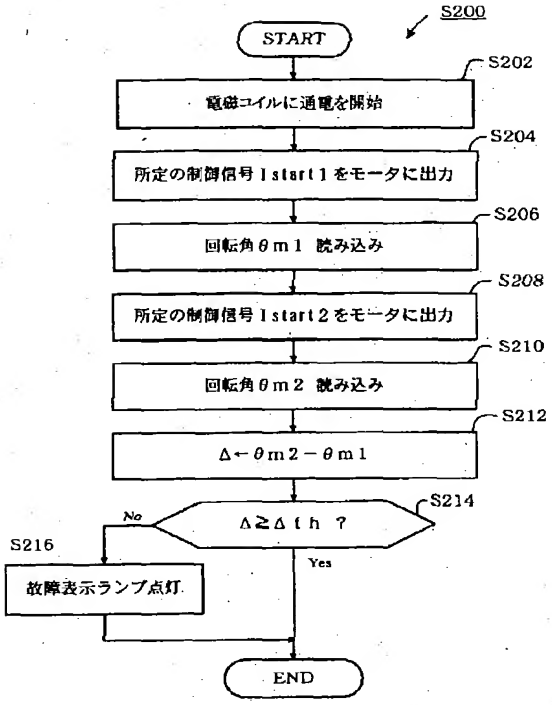
【図４】



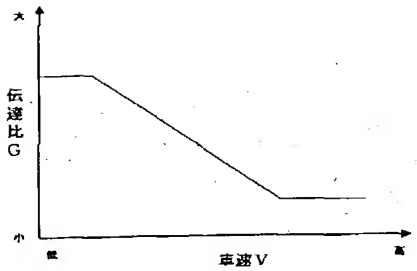
【図５】


START
S200
ロック解除制御
S102
操舵角θh、回転角θm、車速V の読み込み
S104
車速Vに応じて伝達比Gを設定
S106
目標回転角θmm＝（G－1）・θh ／Kを設定
S108
偏差 e＝θmm－θm
S110
制御信号Ｉs＝C（s）・e 決定
S112
制御信号Ｉsに応じてモータを駆動
S114
No
IG OFF ？
Yes
S300
ロック制御
END

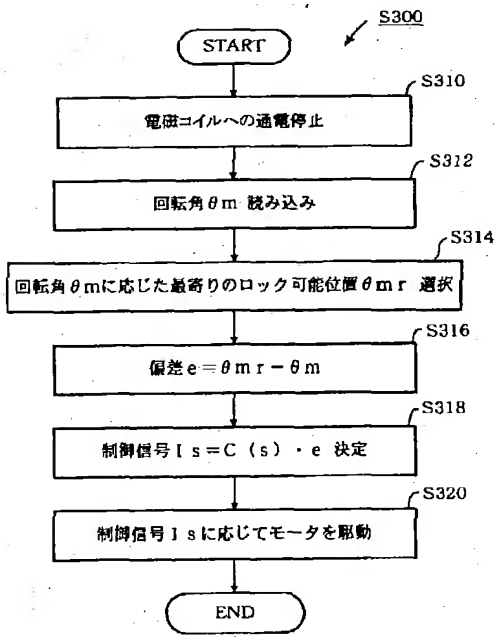
【図６】


S200
START
S202
電磁コイルに通電を開始
S204
所定の制御信号Ｉstart１をモータに出力
S206
回転角θm１ 読み込み
S208
所定の制御信号Ｉstart２をモータに出力
S210
回転角θm２ 読み込み
S212
Δ←θm２－θm１
S214
No
Δ≧Δｔｈ ？
Yes
S216
故障表示ランプ点灯
END

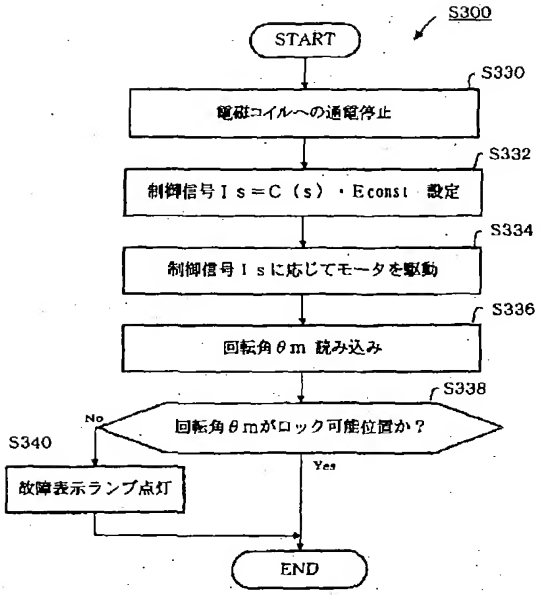
【図７】


大
伝達比G
小
低
車速V
高

【図８】


S300
START
S310
電磁コイルへの通電停止
S312
回転角θm 読み込み
S314
回転角θmに応じた最寄りのロック可能位置θmr 選択
S316
偏差e＝θmr－θm
S318
制御信号Ｉs＝C（s）・e 決定
S320
制御信号Ｉsに応じてモータを駆動
END

【図９】



フロントページの続き

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